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Water Parameter and Quantity of Microorganisms from the Natural Pond, Loilem Township, Southern Shan State

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Abstract

The research was reported the water parameter and quantity of microorganisms from natural pond, Loilem Township, Southern Shan State. The objective was to know whether the natural pond is suitable or not to aquatic organisms and animals. The results of water parameter were within the permissible limit assigned by WHO standard except colour and turbidity. Four study sites were divided on this pond and the water samples were monthly collected. Four groups of microorganisms observed were phytoplanktons, diatoms, cyanobacteria and zooplanktons. Among these four groups, the largest total number percentage (%) was recorded as 32.42% in phytoplankton group, 29.41% in diatom group and 24.59% in zooplankton group during the study period. The lowest total number percentage (%) was 13.57% in cyanobacteria group. It is therefore the natural pond is recommended as non-blooming situation. In addition, non polluted water is ready to drink for some birds and animals that are live in and around these environs. It may be concluded that the water physicochemical parameters and quantity of microorganisms from this pond is suitable condition for aquatic organisms and animals as well as recreation for people.

Keywords: natural pond, microorganisms, water quality and quantity.

Introduction

In natural pond, one factor of water pollution is based on the effect of water quality and quantity. It is necessary to study on the water quality which is favorable for the good water condition in natural pond. In addition, the significantly influenced of microorganisms may lead to conclude the quality and quantity of water in pond. Water pollution is one of the main crises faced by millions of people and majority of water-borne diseases are spreading because of the poor quality of water (El-Adly *et al.*, 2008).

Microorganisms are found in the water of natural pond and they can be observed blooming type under favorable conditions such as light, nutrients and environmental condition. Blooming microorganisms in the water gave positive and negative effect of their environment and aquatic animals. It is therefore aquaculturists were investigated microorganisms in the fresh water of natural pond and lake. Phytoplankton is microorganism which possesses important roles in the waters, not only as primary producer in food chain but also one of the parameters for fertility level of the waters (Veronica, 2014).

There are 43 species of freshwater fishes found in Loilem Township reported by Nwe Nwe Yin, *et al.*, 2005. The research should be concerned about the

characterization of water quality and quantity which play a vital role in aquatic live food or supplement feed for fish. Live food organisms include all plants (phytoplankton) and animal (zooplankton) lives grazed upon by economically important fishes (Das, *et al.*, 2012). Beside these, some birds and animals around these environs depend to drink water.

This research tend to be investigated the effect of water quality in natural pond are beneficial or harmful to aquatic animals in this pond. The previous studies of the effect of water quality and quantity in natural pond, Loilem Township was lacking to date in Department of Zoology, Panglong University. It may thus be considered for the effect of water quality and quantity in natural pond is needed to examine. Thus it is undertaken on the water quality of in this pond according to the following objectives.

Objectives of the study

1. To investigate and determine the water quality of natural pond, Loilem Township,
2. To study and record the quantity of microorganisms in water sample,
3. To know about the pond is suitable or not for aquatic organisms and animals.

Research Methodology

1. Study site and period

The study site is natural pond, Loilem Township which situated at latitude 21° 18' 54" N and 21° 19' 41" N, and at longitude 95° 2' 38" E and 95° 3' 43" E. It is a significant area of natural freshwater pond in in Loilem Township. The length is 2334 ft and the widest point is 1867 ft in width (Fig 1). The study period was carried out from June 2016 to June 2017.

2. Sample collections

The water samples were monthly collected from the study site of natural pond, Loilem Township for the study. There were four study sites divided on this pond: Site I was east of pond, Site II was west of pond, Site III was south of pond and Site IV was north of pond, Loilem Township (Fig.2). From each study site, the water sample put into the sterile-bottles and immediately taken to the laboratory of Zoology Department, Panglong University.

3. Equipment and preparation methods

Light microscope, beaker, micropipette and pointer were used. Firstly, each collected water sample from sterile plastic bottles was placed setttable for sedimentation. Secondly, after sedimentation the supernatant and bottom water of each sterile plastic bottles were carefully put in beaker. Thirdly, water sample in beaker was carefully stirring and than 0.1 ml (one drop of water) was collected with micropipette and placed on a glass slide and covered with cover slip for the observation of microorganisms.

4. Identification methods

The taxonomic identification of microorganism was immediately carried out after observation of water sample. This involved identification of dominant microorganism in the water sample as well as the composition of it. Carefully examined by counting the number of cells under light microscope (with the

magnification of x100 and x400); at least 5 slides were observed. The occurrence of microorganisms were roughly recorded on each slide as abundance ($n > 20$), few ($n > 10$) and rare ($n < 5$). The average percentage (amount and compositions) of microorganisms on the glass slide were also calculated.

The occurrence and quantity of microorganisms were roughly recorded on each slide by the method of Jochem (2001) and Elder (2003). Microorganisms were identified down to the genus and species level according to Desikachary (1959), Edmondson (1966) and Bellinger and Sigeo (2010). The recorded microorganisms were taken as microphotographs (with the magnification of x40, x100 and x400) by using camera attached to digital microscope at Department of Zoology, Taunggyi University and Mandalay University.

5. Water analysis

The analysis of water was made in the Laboratory of Water Supply and Sanitation Department, Mandalay City Development Committee (MCDC) for determination of physicochemical factors such as pH, colour, turbidity, conductivity, calcium, total hardness, magnesium, chloride, total alkalinity, total iron, manganese and sulphate.

6. Weather data collection

Temperature, humidity and rainfall data were obtained from Department of Meteorology and Hydrology, Loilem Township, Southern Shan State, during the study period.

Results

The physical parameter of water from natural pond were pH was 7.1, colour was >50 , turbidity was 58.9 NTU and conductivity was 475 $\mu\text{S}/\text{cm}$. The chemical parameter of water also Calcium (Ca) was 64 ppm, total hardness (CaCO_3) was 168 ppm, Magnesium (Mg) was 5 ppm, Chloride (Cl) was 8 ppm, total alkalinity was 160 ppm, total iron (Fe) was >0.2 ppm, Manganese (Mn) was 0.03 ppm and Sulphate (SO_4) was <200 ppm. In Loilem Township, the average rain fall was 6.06 Inch and average humidity was 81.43%. The average minimum temperature was 13.8°C and maximum was 26.26°C during the study period.

In the present study, there are four groups of microorganisms divided were phytoplankton, diatom, cyanobacteria and zooplankton. Monthly recorded microorganisms found in water sample from natural pond was shown in Fig. 3 and total composition percentage (%) of microorganisms under four groups in terms of number was also shown in Fig. 4.

Microorganisms in water sample from natural pond in terms of grouping by genera were shown in Table 1. Microorganisms in water sample from natural pond under phytoplanktons group with phyla in terms of quantity were shown in Table 2. Microorganisms in water sample from natural pond under diatoms and cyanobacteria group with phyla in terms of quantity were shown in Table 3. Microorganisms in water sample from natural pond under zooplanktons group with phyla in terms of quantity were shown in Table 4.

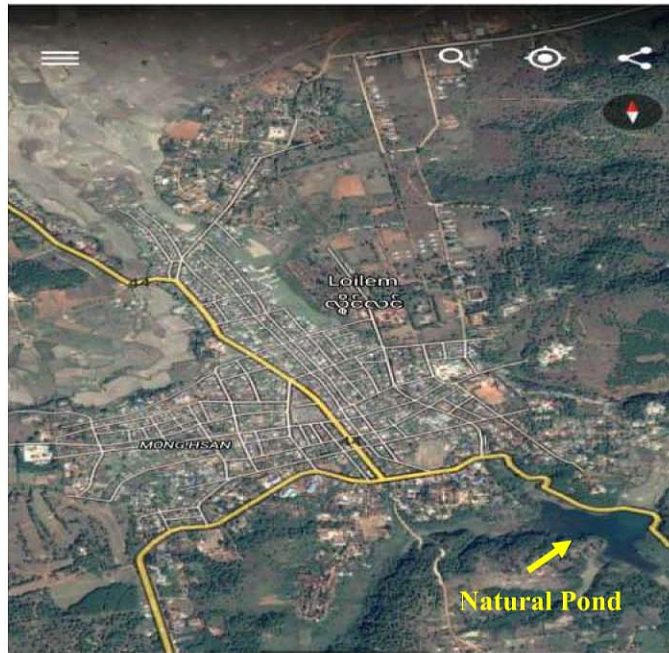


Figure 1: Location map of natural pond, Loilem Township
(Source: Google earth)



Figure 2: Four sample collection sites of natural pond, Loilem Township
(Source: Google earth)

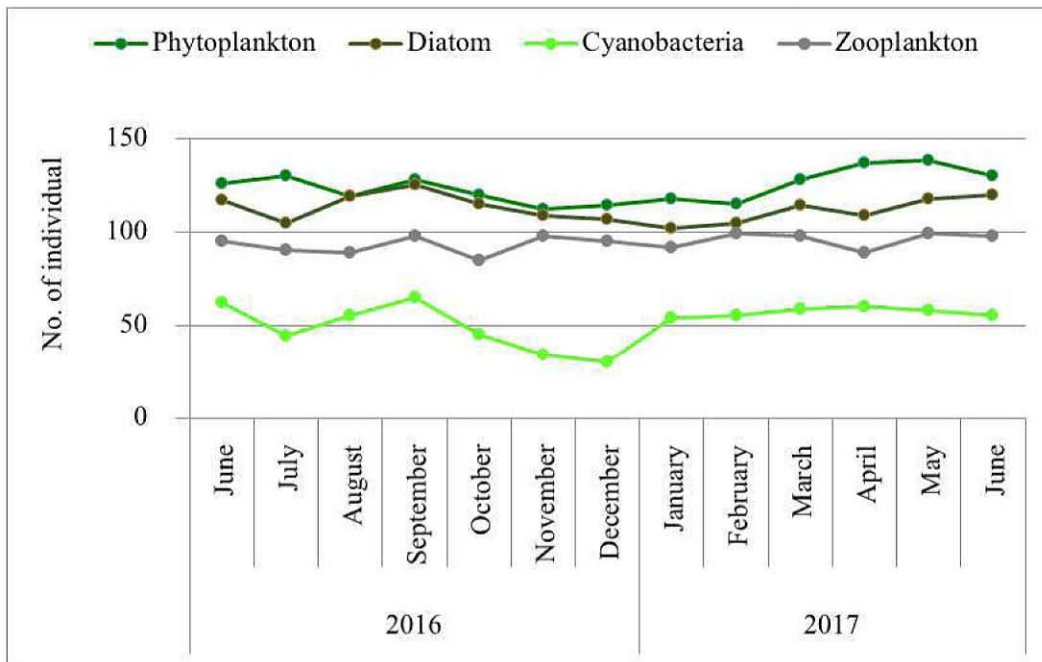


Figure 3: Monthly record of microorganisms found in water sample from natural pond

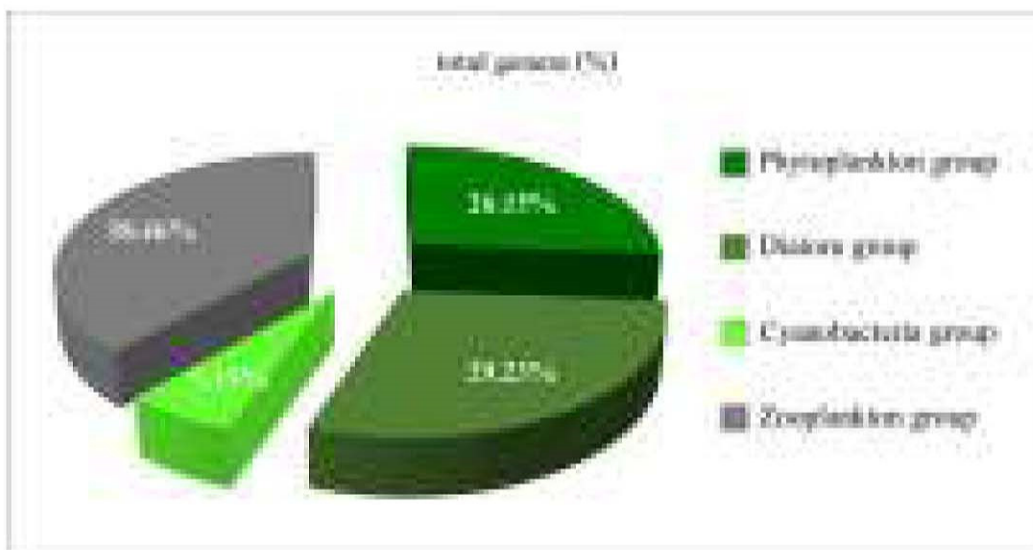


Figure 4: Total composition percentage (%) of microorganisms under four groups in terms of number

Table 1

Microorganisms in water sample from natural pond in terms of grouping by genera names

No.	Name of the genera in groups			
	Phytoplanktons	Diatom	Cyanobacteria	Zooplanktons
1	<i>Chlorococcum</i>	<i>Stauroneis</i>	<i>Chroococcus</i>	<i>Actinosphaerium</i>
2	<i>Eudorina</i>	<i>Neidium</i>	<i>Merismopedia</i>	<i>Acanthocystis</i>
3	<i>Pediastrum</i>	<i>Navicula</i>	<i>Oscillatoria</i>	<i>Actinophrys</i>
4	<i>Westella</i>	<i>Caloneis</i>	<i>Lyngbya</i>	<i>Amoeba</i>
5	<i>Tetraedron</i>	<i>Gyrosigma</i>		<i>Dinobryon</i>
6	<i>Oocystis</i>	<i>Amphipleura</i>		<i>Euglypha</i>
7	<i>Coelastrum</i>	<i>Fragilaria</i>		<i>Diffflugia</i>
8	<i>Scenedesmus</i>	<i>Synedra</i>		<i>Centropyxis</i>
9	<i>Schroederia</i>	<i>Epithemia</i>		<i>Arcella</i>
10	<i>Cosmarium</i>	<i>Gomphonema</i>		<i>Coleps</i>
11	<i>Closterium</i>	<i>Pinnularia</i>		<i>Tetrahymena</i>
12	<i>Staurastrum</i>	<i>Cymbella</i>		<i>Paramecium</i>
13	<i>Pithophora</i>	<i>Amphora</i>		<i>Euplotes</i>
14	<i>Ulothrix</i>	<i>Nitzschia</i>		<i>Stylonychia</i>
15	<i>Euglena</i>	<i>Surirella</i>		<i>Vorticella</i>
16	<i>Phacus</i>	<i>Cyclotella</i>		<i>Notholca</i>
17	<i>Peranema</i>	<i>Diatoma</i>		<i>Lepadella</i>
18		<i>Peronia</i>		<i>Keratella</i>
19		<i>Tribonema</i>		<i>Argonotholca</i>
20				<i>Monostyla</i>
21				<i>Macrocyclus</i>
22				<i>Cyclops</i>
23				<i>Daphnia</i>
24				<i>Phagocata</i>
25				<i>Lepidodermella</i>

Table 2

Microorganisms in water sample from natural pond under phytoplankton group with phyla in terms of quantity

Phylum	Genus	Abundance	Few
Rare			
Chlorophyta	<i>Chlorococcum</i>		+
	<i>Eudorina</i>		+
	<i>Pediastrum</i>	+	
	<i>Westella</i>		+
	<i>Tetraedron</i>	+	
	<i>Oocystis</i>		+
	<i>Coelastrum</i>		+
	<i>Scenedesmus</i>	+	
	<i>Schroederia</i>		+
	<i>Cosmarium</i>	+	
	<i>Closterium</i>	+	
	<i>Staurastrum</i>		+
	<i>Pithophora</i>		+
	<i>Ulothrix</i>		+
	Euglenophyta	<i>Euglena</i>	+
<i>Phacus</i>			+
<i>Peranema</i>			+

abundance (n > 20); few (n > 10); rare (n < 5); n=number

Table 3

Microorganisms in water sample from natural pond under diatom and cyanobacteria groups with phyla in terms of quantity

Phylum	Genus	Abundance	Few	
Rare				
Chrysophyta	<i>Stauroneis</i>	+		
	<i>Neidium</i>		+	
	<i>Navicula</i>	+		
	<i>Caloneis</i>	+		
	<i>Gyrosigma</i>		+	
	<i>Amphipleura</i>		+	
	<i>Fragilaria</i>	+		
	<i>Synedra</i>		+	
	<i>Epithemia</i>			+
	<i>Gomphonema</i>			+
	<i>Pinnularia</i>	+		
	<i>Cymbella</i>	+		
	<i>Amphora</i>	+		
	<i>Nitzschia</i>			+
	<i>Surirella</i>			+
	<i>Cyclotella</i>		+	
	<i>Diatoma</i>		+	
	<i>Peronia</i>			+

Cyanophyta	<i>Tribonema</i>		+
	<i>Chroococcus</i>		+
	<i>Merismopedia</i>	+	
	<i>Oscillatoria</i>	+	
	<i>Lyngbya</i>		+

abundance (n > 20); few (n > 10); rare (n < 5); n=number

Table 4

Microorganisms in water sample from natural pond under zooplankton group with phyla in terms of quantity

Phylum	Genus	Abundance	Few
	Rare		
Protozoa	<i>Actinosphaerium</i>	+	
	<i>Acanthocystis</i>		+
	<i>Actinophrys</i>	+	
	<i>Amoeba</i>		+
	<i>Dinobryon</i>		+
	<i>Euglypha</i>	+	
	<i>Diffugia</i>		+
	<i>Centropyxis</i>		+
Amoebozoa	<i>Arcella</i>		+
Ciliophora	<i>Coleps</i>	+	
	<i>Tetrahymena</i>	+	
	<i>Paramecium</i>		+
	<i>Euplotes</i>	+	
	<i>Stylonychia</i>	+	
	<i>Vorticella</i>		+
Rotifera	<i>Notholca</i>	+	
	<i>Lepadella</i>		+
	<i>Keratella</i>		+
	<i>Argonotholca</i>		+
	<i>Monostyla</i>		+
Arthropoda	<i>Macrocyclus</i>		+
	<i>Cyclops</i>		+
	+		
	<i>Daphnia</i>		+
Platyhelminthes	<i>Phagocata</i>		+

Chaetoida

Lepidodermella

+

abundance (n > 20); few (n > 10); rare (n < 5); n=number

Discussion

This research was reported that the water quality and quantity of natural pond, Loilem Township and was determined suitable or not for aquatic organisms and animals live in and around these environs.

The most common weather indicators are rainfall, humidity and temperature. In Loilem Township, the average rain fall was 6.06 Inch and average humidity was 81.43%. The average minimum temperature was 13.8°C and maximum was 26.26°C during the study period. These values were fall within the range for aquaculture recommended. The temperature range of 29.8-30.4°C is good for the phytoplankton (Veronica, *et al.*, 2014). The polluted or nonpolluted water quantity and quality depends on the environmental, geological, biological and climatological condition. Although the plankton blooms that result from fertilization can be highly desirable, too much bloom can cause problems (Brunson, *et al.*, 1999).

In this research, the pH value was 7.1, and 7-8.5 as in WHO standard. The measurement of pH is to know acidity or alkalinity of water and the pH scale 7 is neutral. The result show pH value of water is suitable for aquatic microorganisms and natural this pond ecosystem. Thus pH of water from natural this pond is found to be the range between neutral and alkaline condition. The result agree to that of Ahmed, *et al.*, 2003, they observed the value of pH in the river water found to range from neutral to alkaline (7.0-8.0) at the sampling stations.

The colour of water sample was >50, and 5 in desirable by WHO standard but imperative was 50. This result showed the colour of water is imperative condition compared to WHO standard. The turbidity of water sample in this this pond is 58.9, and 5 NTU in desirable and 25 NTU in imperative as WHO standard. The result also shows that more than imperative condition compares to WHO standard. The conductivity is show 475 micros/cm in the present examination.

According to the chemical analysis, the parameters such as Calcium (Ca) is 64 ppm, total hardness (CaCO₃) is 168 ppm, Magnesium (Mg) is 5 ppm, Chloride (Cl) is 8 ppm, total alkalinity is 160 ppm, total iron (Fe) is >0.2 ppm, Manganese (Mn) is 0.03 ppm and Sulphate (So₄) is <200 ppm in the present study. As desirable and imperative chemical analysis of WHO standard, for Ca 75 ppm and 200 ppm, CaCO₃ 100 ppm and 500 ppm, Mg 30 ppm and 150 ppm, Cl 200 ppm and 600 ppm, total alkalinity 200 ppm and 500 ppm, Fe 0.1 ppm and 1.0 ppm, Mn 0.05 ppm and 0.5 ppm, So₄ 200 ppm and 400 ppm respectively. Therefore, the result values of all chemical parameters showed within the acceptable range and permissible value.

The physicochemical parameters of freshwater are important to the population of microorganisms in the water and animals. The present finding showed physicochemical parameters of water are suitable for aquatic microorganisms and animals except colour and turbidity. The higher imperative result of colour and turbidity may be possible that during the water sample collection, this natural this pond was prepared to Mya Kan Thar Resort Park by digging soil.

The present results revealed that there are four groups of microorganisms such as phytoplankton's group (phyla Chlorophyta and Euglenophyta), diatom group (phylum Chrysophyta), cyanobacteria group (phylum Cyanophyta) and zooplanktons group (phyla Protozoa, Amoebozoa, Ciliophora, Rotifera, Arthropoda, Platyhelminthes and Chaetoide) divided from the results of present study.

Among these four groups, the largest total number percentage (%) was recorded as 32.42% in phytoplankton group followed by 29.41% in diatom group and 24.57% in zooplankton group during study period. The lowest total number percentage (%) was also recorded as 13.57% in cyanobacteria group. According to the results phytoplankton, diatom and zooplankton groups are dominant species in natural this pond. However blooming condition was not found when water sample collection and thus it can be assumed non-polluted still now.

The results of microorganism's composition were found nearly the same and distinctly not differ. In food chain, phytoplankton is eaten by herbivores (such as zooplankton) which will also be eaten by larger carnivores (fish and others) and etc. (Veronica, *et al.*, 2014). However the lowest total number and genus percentage was found in cyanobacteria group.

Nevertheless, many microorganisms community are altogether observed in this this pond. The microorganisms serve as the base of the aquatic food web, providing an essential ecological function for all aquatic life. They have also high protein content not only which is abundantly occurred in natural this pond but also suitable live food for fishes. New New Yin, *et al.* (2006) studied that 26 species of fish were collected from Loilem environ. The research data will be guideline for next study and needed for future study of monitoring this this pond.

The research was concluded that physicochemical parameters of water and quantity of microorganisms from natural pond, Loilem Township. Physicochemical parameters of water are within permissible value for aquatic organism's based on the results of the physical examination and chemical analysis. The quantity of microorganisms were found non-blooming situation and divided into four groups such as phytoplanktons, diatoms, cyanobacteria and zooplanktons in natural pond. The dominance group of microorganisms found in water sample was phytoplankton followed by diatom and zooplankton groups. According to the results, it may be concluded that the physicochemical parameters of water and quantity of microorganisms in this lake is suitable condition for aquatic organisms. In addition, non-polluted water is ready to drink for some birds and animals that are live in and around this environ.

Recommendations

The water quality and quantity of microorganisms in this pond are also suitable conditions as recreation for people coming to natural pond, Loilem Township. The results will provide a tool for biomonitoring of aquatic status and environmental health in natural aquatic ecosystem. It is therefore the natural pond is recommended as suitable for aquatic organisms and animals.

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